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Integrated logistics and election performance: a systematic literature review

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ABSTRACT

Elections are typically seen through the lens of political frameworks, overlooking the profound impact of logistics on election performance. Through a systematic literature review, this study explores the integral role of logistics in election performance. It highlights the links between logistics functionality performance and perceptions of electoral integrity. The findings reveal that as prerequisites, elections require specialised logistics systems integrated with inclusive I.T. and the human side to ensure dependability, increased visibility and security during the transportation and warehousing of sensitive electoral materials throughout election cycles. The findings identify distinct challenges faced by developed and developing countries, particularly concerning reverse logistics, warehousing, transport networks, distribution planning and technological infrastructure, suggesting the need for tailored logistics strategies based on national development status. Finally, the study emphasises the imperative involvement of logistics experts to ensure the effective integration of logistics functions within elections, oversight and the strategic development of an election logistics field.

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KEYWORDS
Election logistics; election administration; systematic literature review; election performance; integrated logistics; electoral supply chain management

1. Introduction

Despite global challenges and the wide spate of variations in national nomenclature, satisfaction or dissatisfaction with outcomes (Fielding 2018), elections remain the determinant of national leaders and policies across democratic nations. Similarly, multiparty elections have become increasingly commonplace, and democratic studies have discovered that the perception of the electorates regarding the quality of the administration of elections impacts their confidence in elected leaders (Moehler 2009), their contentment with democratic achievements during the tenure (Norris 2014), political participation post elections (Bratton 2013), and their overall trust in the electoral processes (Iwuoha et al. 2021). However, in developing nations, particularly in sub-Saharan Africa, elections take on a resemblance to warfare, with the involvement of military forces, armed police, and paramilitary functionalities, transforming what should be a democratic exercise into a deeply concerning and volatile situation (Agu, Okeke, and Idike 2014; Okoye 2011). Where elections take place in such volatile scenarios, the frequency of election cycles not only represents huge costs, planning, and logistics inputs, but also periodic loss of lives. For the electorate, elections are a product or service, and they are the customers.

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Election logistics (EL) is concerned with the activities leading up to elections, election day activities, as well as post-election day activities, including the transmission of results and transportation of electoral materials to and from polling units. EL is critical and complex as it caters to a spectrum of activities, including planning, coordination, execution, and the effective management of the delicate, interdependent tasks of strategically moving, transporting, and distributing electoral materials, as well as personnel across requisite points during elections (Iwuoha et al. 2021). EL further encompasses the personnel welfare, security, hardware, emoluments, and shelter during the execution of electoral responsibilities (Kerr 2018).

While there is a substantial body of work on logistics and logistics capabilities (e.g. Tukamuhabwa, Mutebi, and Kyomuhendo 2021), as well as elections, electoral issues, and democratic development (e.g. Asunka et al. 2019; Fielding 2018; Kerr 2018), there appears to be a relative dearth of literature on the subject of EL and the role of logistics in elections, even though the subject carries significant weight and implications. The impact of logistics is especially evident when evaluating its financial burden on the overall election budget. For example, during the 2012 general elections in Ghana, a budget of 243,528,305 Ghanaian cedis was allocated, with more than 35% of the budget earmarked for material logistics, staffing and voter awareness campaigns (Debrah, Effah, and Owusu-Mensah 2019). Another example is the UK referendum election of 2011, which incurred a total cost of £58.2 million pounds (Cowling 2013). Of this figure, 40.7% was spent on various logistics-related activities (e.g. forward, and reverse logistics (RL) for postal votes, transportation of votes to collation centres, and vote counting). These figures represent substantial investments in logistics and the necessary infrastructure to facilitate the seamless execution of expansive democratic exercises.

1.1. The scope of election logistics

The nature and scope of the logistics plan, as well as the design of logistics systems, are critical to the effective conduct of free and fair elections in democracies (Kuo and Teorell 2017).

> Election logistics deals with the whole gamut of planning, techniques, organisation, implementation system, and control of the complex and interdependent tasks of the movement, transportation, and distribution flow of election materials and officials from one location to the other during elections. (Iwuoha et al. 2021)

EL fundamentally depends on conventional logistics functions and involves the systematic dissection of electoral processes into granular sub-tasks. It includes but is not limited to, forecasting demand for personnel required, quantifying the volume and quality of materials for procurement, determining the allocation of personnel and materials per polling unit, strategic organisation of distribution and transport capabilities, identifying competent individuals designated for specific responsibilities, the development of a risk management plan – encapsulating a robust security framework to ensure the safety of electoral officials and materials throughout various stages of the electoral processes (Iwuoha et al. 2021). Security is critical during transportation to and from polling units, distribution of electoral materials across different regions, as well as during storage and warehousing at different points within the logistical chain (Iwuoha 2018). A summary of the traditional elements of logistics involved in the electoral process can be found in Table 1.

The comprehensive plan delineates facets of EL, spanning material procurement, inbound and outbound logistics, RL, inventory management, warehousing, personnel remuneration, welfare provisions, and overarching safety protocols. Achieving seamless execution of this multifaceted plan necessitates the attainment of the optimum level of logistics integration, a system thinking approach, and supply chain orientation. In the context of elections, RL involves the movement of used ballot papers, result sheets and authorised electoral officials, such as those in Electoral Management Bodies (EMBs) and local municipal councils to collation centres; it also involves the movement of other sensitive electoral materials and equipment to points of storage, such as unused voting papers, voting booths, biometric equipment, etc. Consequently, for EL to be successful

Table 1. Classification of logistics activities in election process (Source: Authors, developed from Iwuoha et al. 2021; Kerr 2018).

Logistics components	Example of activity
Material Procurement	• Procuring ballots, voting booths, and other materials • Ensuring quality and quantity of materials procured
Inventory Management	• Managing inventory of election materials • Tracking and monitoring inventory levels during election cycle • Conducting regular inventory audits
Warehousing	• Ensuring secure storage of election materials • Implementing warehouse management systems • Ensuring proper storage conditions for materials
Transport & Distribution	• Arranging transportation for election materials • Distributing election materials to polling stations • Implementing efficient transport routes • Coordinating with transport providers

and efficient, there should be a plan for a closed-loop supply chain. Figure 1 illustrates a comprehensive representation of the logistics process involved in an election.

Where there is a lack of strategic logistics capacity planning, the overall outcome of the EL process could be significantly compromised and deemed unacceptable. For instance, issues around material handling, speed, dependability and security (such as the failure to securely transport and store sensitive used and unused ballot papers, or the failure to securely transport specialised IT equipment used for data capture or the failure of electoral materials to reach voters on voting schedule), could adversely affect election outcomes. This could result in the erosion of voter confidence and trust in the integrity of the entire electoral system (Iwuoha et al. 2021). Consequently, this loss of trust and confidence could lead to voter apathy in subsequent elections as well as public discontent, potentially leading to the outright breakdown of law and order.

In this sense, the logistics performance of elections is evaluated based on the secure movement and storage of all election-related materials, equipment and personnel; the strategic organisation of warehousing systems; the timely arrival and removal of electoral materials (including postal votes)

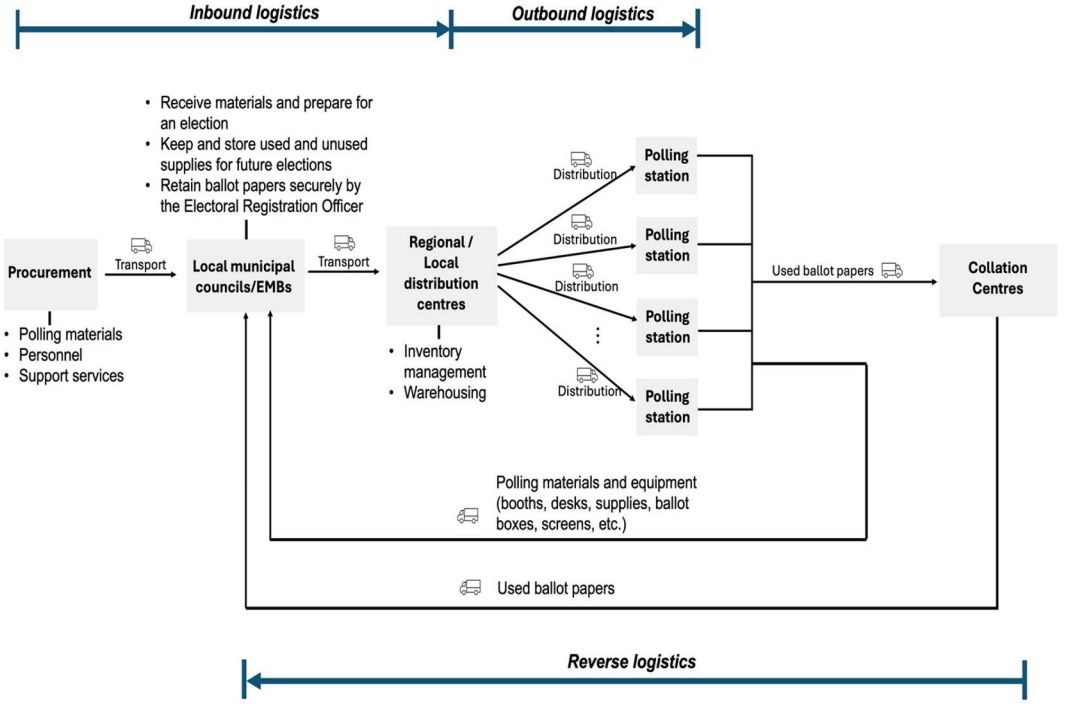

Figure 1. Electoral logistics process (Source: Authors, developed from Charles, Ndolo, and Odari 2023; Iwuoha et al. 2021).

on election day; the reliability of the transport modes, and the adaptability of the logistics systems to physical challenges. While there are existing literature exploring the relationship between logistics and elections, only a limited number of academic papers have explicitly considered the importance of logistics to election performance (EP). In this context, election performance refers to the successful conduct of elections within the prescribed time, conducted according to pre-determined electoral procedures and legislation where voter registration, voting process, and vote counting are devoid of voting irregularities such as lost ballots, insecure postal ballots, electoral fraud and general election integrity issues. These performance indicators inform the perceived acceptance of elections in terms of legitimacy, transparency, credibility, and reliability of election outcomes (Musiał-Karg and Kapsa 2021; Willemson 2018). Drawing from the concepts defined, this study conceptualises the connection between logistics and election performance as depicted in Figure 2, illustrating effective logistics are essential for determining the overall quality of the performance of elections.

Hence, the aim of this paper is to investigate the role of logistics within the confines of elections. This study focuses on examining the performance of logistics and relative capabilities (i.e. service quality, speed, dependability, accuracy, agility, material handling and security) as they relate to the successful administration of elections. To achieve this, the paper employs a systematic literature review of existing literature, providing valuable insights into the contemporary position of the subject of EP and paving the way for future studies in EL studies. By emphasising the critical role played by logistics, this study presents a foundation for future exploration into the optimal application of logistics, transportation, warehousing systems and models, in developed and developing nations when planning for elections and addressing associated challenges. To achieve this, the study attempts to address the following research questions:

(i) What are the functional dimensions of logistics in election performance?
(ii) What are the prevalent logistics challenges within election process?
(iii) What potential research directions can be explored within the context of election logistics?

Election administration has significant implications for social justice, and where electoral conflicts exist, they impact the acceptance of legal and institutional processes (Nadeau and Blais 1993). Even though election management systems cut across multiple disciplines such as politics, social sciences and logistics, it has been largely neglected within the logistics and supply chain management domain. Therefore, this review contributes to the logistics literature by developing a conceptual framework which reveals the complex interdependencies between logistics systems and electoral administration.

For logistics practitioners, the main significance of this paper is that it provides insights into the nature of complexities and challenges of the logistics arm of election administration. It denotes the unique role which logistics plays in the smooth conduct of elections, the need for the deployment of logistics management principles, and the involvement of expert logisticians in election planning.

The rest of the paper is structured as follows: Section 2 presents the method applied for the identification and subsequent synthesis of extant publications on EL. After which, Section 3, utilises an inductive technique to uncover the research trends, classifying the predominant research clusters emerging

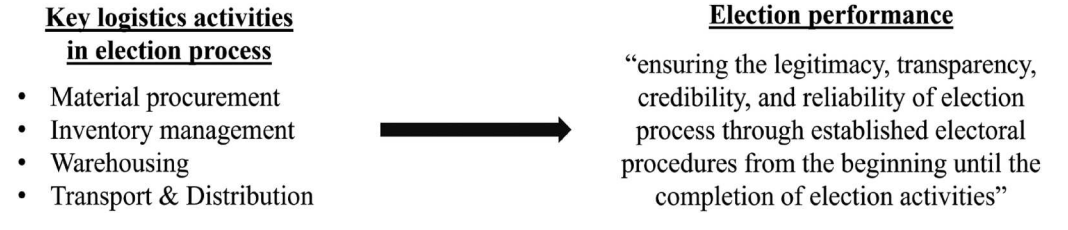

Figure 2. Logistics and election performance (Source: Authors).

from the synthesis and elucidating the core themes within clusters, as well as their consequent relevance to the existing and future body of knowledge. Section 4 then concludes by highlighting the implications for future research within the discussion on EL and presents an outline of its contributions.

2. Methodology

This study adopted an inductive systematic review approach (Pournader et al. 2020; Seuring and Gold 2012) to explore and examine extant literature on EL. Petticrew and Roberts (2008) proposed that the adoption of systematic reviews is particularly appropriate in situations where limited insights exist into a phenomenon, making it an apt choice for exploring the nuanced realm of EL. This review considered all identifiable extant publications up to June 2023.

2.1. Systematic literature review

The goal of a systematic review is to identify, sort and synthesise large amounts of research data utilising explicit sifting strategies and protocols in a bid to address pertinent research questions (Petticrew and Roberts 2008).

In this research, the systematic review methodology presented by Denyer and Tranfield (2009) was employed, a framework widely recognised in the field of management sciences, due to its credibility (See Lim et al. 2019; Winkelhaus and Grosse 2020).

Keyword development: Based on the research questions and the main themes captured within EL scope, the preliminary search threads utilised the following keywords: 'election', 'logistics', 'performance', and 'assessment'. A further iterative protocol utilised additional structured keywords including 'elections' OR 'election' OR 'electoral' AND 'logistics'; 'voting logistics' OR 'voter logistics'; 'electoral systems' OR 'electoral integrity' OR 'electoral quality' OR 'election logistics performance' AND 'logistics'.

These search parameters were applied, considering potential variations between the keyword types. An asterisk was also placed at the end of search terms so as to potentially extend the search range and consider other word derivates (Gimenez and Tachizawa 2012; Lim et al. 2019). The study applied the Boolean logic 'AND' to potentially link different search phrases, as well as 'OR' to cater for synonyms for advanced searching (Gu and Lago 2009). Examples include, 'election OR elections OR electoral' AND 'logistics OR logistics performance OR logistics systems'. This study only included publications where at least one keyword or key phrase appeared in the title, abstract, or list of keywords. The scope of this literature search was limited to the end of June 2023.

Search repositories: Preliminary searches were conducted utilising Scopus. Further searches were extended to other repositories to avoid the possibility of excluding relevant literature, improving the rigour of the review protocol (Lim et al. 2019). The additional journal repositories searched included Emerald Insight, EBSCO, Google Scholar, and Web of Science. In addition, the study considered that there is likely an intersection of publications and thus a manual search of the bibliographies and reference lists of the reviewed publications was necessitated, thereby ensuring an exhaustive coverage of the literature (Lim et al. 2019; Winkelhaus and Grosse 2020).

Inclusion and exclusion criteria: This review based its inclusion and exclusion parameters on the protocols proposed by Petticrew and Roberts (2008). The study limited its review to publications from peer-reviewed journals (Colicchia and Strozzi 2012). As per exclusion, the study excluded conference publications and proceedings, academic theses, book chapters (Petticrew and Roberts 2008), as well as other grey publications such as white papers, government documents, working papers, and reports (Lim et al. 2019). In the case of working papers, it is often the case for the finalised outputs to be published in academic journals (Davarzani et al. 2016), and thus the deliberate exclusion of these types of papers limits the chances of duplication in the selected literature. Additionally, this study included only articles with full-text availability and text published in English. Regarding dates, the review did not apply any publication year limitation, and this was done to fully capture the scope of extant publications in the area.

2.2. Paper selection and evaluation

The study included relevant subject areas, encompassing business, management, economics, public administration, social sciences, political sciences, technology, and multidisciplinary studies. This extensive inclusion stemmed from the recognition that the domain of logistics within the context of the election process is relatively underexplored and lacks firm establishment. In this context, where the absence of standardised terminology, namely 'election logistics', exists, analogous concepts within varied disciplines might be addressed using diverse terminology or concepts. Hence, this extended scope ensured a holistic identification of the research topic across relevant academic domains. Each stage of the search and evaluation process was a collective discursive process involving both authors to ensure consensus on paper quality, validity and relevance to the topic.

By applying the specified keywords, an initial search by different repositories identified a total of 523 papers. The papers were filtered by reviewing the titles and primarily abstracts to ensure relevance and quality. This methodological approach was crucial due to the inherent limitation of paper titles, which often fail to provide sufficient insight into the scope and context of papers (Gu and Lago 2009). Following this preliminary screening, articles displaying evident keywords and indicating a potential relationship were subjected to thorough scrutiny of the full article to verify relevance (Winkelhaus and Grosse 2020).

Articles were deemed as irrelevant if they had a limited focus on the logistics aspects of elections or neglected the evaluation of EP from a logistics standpoint. The study selected articles that primarily maintained their focus on the context of logistics: electoral material logistics, inbound logistics, information flow management, material storage, operations, technology application, data transmission, personnel logistics, election administrators, manual handling, personnel skills, cost, voter logistics (including registration and wait times), forward outbound logistics, RL, data management, disruptions and election administration policy. Furthermore, the focus was limited to country, state, province, and county-wide general elections that require significant logistics capabilities. Consequently, it did not encapsulate localised elections, such as those conducted within legislatures (i.e. for speakership and principal officers), or other forms of electoral exercises. Additionally, owing to the iterative nature of search protocols, duplicated papers appearing in different repositories were eliminated.

Following the keyword search, the first observation within the literature is the use of the term 'election performance'. In some literature, the term 'election performance' describes electoral victory or loss (see Tatchou 2022; Waggoner 2017). In other words, EP denotes the performance of political actors vying for electoral office. In such cases, the term does not provide insights into the evaluation of elections with regard to the logistics performance. Therefore, studies under such categories were eliminated.

Following the application of the filtering protocols, the number of papers for review was reduced from 523 to 42 papers. Employing the PRISMA 2020 reporting framework, Figure 3 shows the detailed elimination values at each point of the filtration process. The number of 42 papers, representing a 91.9% reduction from the initial population of 523 papers, make up the sample size for this study (see all reviewed papers in the reviewed papers section). This percentage reduction aligns consistently with prior studies within the logistics and supply chain field. These studies tend to have an average decrease in sample size ranging from 95% to 98% (see Abidi, De Leeuw, and Klumpp 2014; Gimenez and Tachizawa 2012; Lim et al. 2019).

3. Research findings

This section provides a descriptive account of the synthesis of information obtained from the selected papers. This synthesis involved an analysis of the articles based on time periods, geographical locations, journals, and subjects, providing an overview of the contextual background of the selected literature.

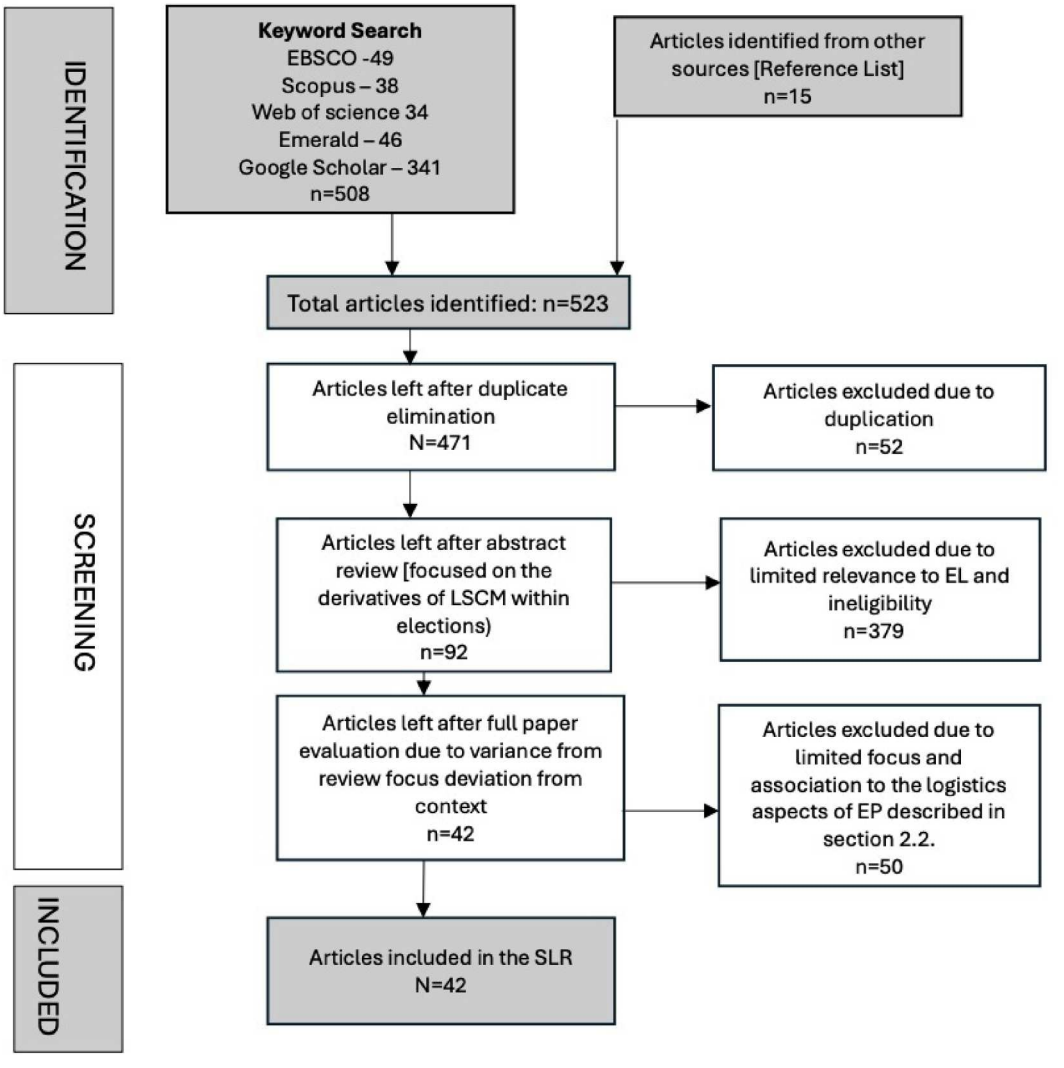

Figure 3. Paper selection procedure (Source: Authors).

3.1. Descriptive analysis

3.1.1. Number and time period of publications

While this review did not consider any date limitation, the earliest related publications found were from 2005. Furthermore, while there were only a limited number of publications in the subject area in the early 2000s (6 publications from 2005 to 2009), it was discovered that there has been a growing interest in the subject as there are 20 published articles (47% of all related publications) between 2010 and 2019, and 16 related publications from 2020 to 2023 – amounting to 38% of the total publications. It is worthy to denote that this paper search was concluded in June 2023. This likely implies that EL is a relatively understudied subject area, and it has begun to generate increasing interest. This recent interest can be related to the increasing dependence on, and application of technology to elections, as well as the pandemic-induced awareness of the impact of logistics and supply chain on trade and societal development. The number of publications per year is illustrated in Figure 4.

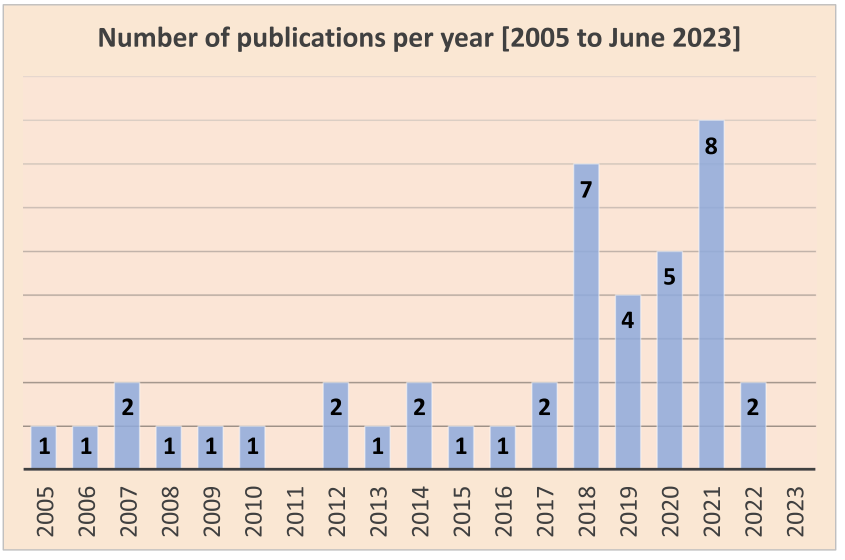

Figure 4. Publications by time-period (Source: Authors).

3.1.2. Analysis by journal base

The majority of the papers have emanated from political science journals and scholars, indicating a lack of interest from other critical subject areas, such as logistics and supply chain management (LSCM), which are key stakeholders in the role of logistics in elections. Interestingly, there was no observed focal publication outlet specifically related to the subject, even within the realms of social and political sciences. This is evident as the published articles have been widely dispersed across 33 journals, with only 5 journals featuring a concentration of more than one article. Furthermore, the only one paper that categorically discussed transportation was published in 'society' journal. This suggests that currently elections are perceived more as public and political concerns rather than logistics and management issues. This further reinforces the need for this review as it signposts the links between logistics and elections, further demonstrating the absence of inputs from logistics researchers and experts, whose stakeholder knowledge inputs are significantly lacking in the subject. The publications categorised by subject areas of journals are summarised in Table 2.

3.1.3. Publications by geography

The purpose of carrying out a geographical scope analysis was to evaluate the relative distribution of academic interest within the subject (Lim et al. 2019). Table 3 presents the research interest from scholars across different countries. Predominant research interest within the subject area has been from scholars in the United States (57.14%), while African scholars published about 16.6% of the reviewed sample (Nigerian scholars making up the greatest density in Africa with 11.9%). Since 2000, the United States has shown sustained interest in the application of technology in elections, constituting a significant portion of publications. Research focus in this area included the role of poll workers, electoral administrators, RL, and inclusivity constraints.

In Africa, Europe and the rest of the world, research interest has been distributed, covering topics such as technology (see Debrah, Effah, and Owusu-Mensah 2019; Iwuoha 2018), disruptions and conflict (see Herron, Thunberg, and Boyko 2015; Lidauer 2022), poll workers and election administrators (see Arowosegbe 2020; Kasim et al. 2021), and transportation (See Iwuoha et al. 2021). Comparatively, it was found that studies emanated from 4 developed countries [United States, Netherlands, Estonia and Poland], and 8 developing countries [Ukraine, Ghana, Nigeria, Indonesia, Bangladesh, Myanmar, Uganda and Pakistan], as illustrated in Figure 5, which shows the publication distribution across countries.

Table 2. Publications by subject areas of journals.

Subject area	Journal	Number
Politics & Social Sciences	Public Administration Review	5
	State Politics & Policy Quarterly	3
	The Policy Studies Journal	2
	Policy Studies	2
	Transforming government, people, process and policy	2
	Modern Asian Studies	1
	Journal of International Development	1
	European Journal of Social Sciences Studies	1
	African Studies	1
	Society	1
	Public Budgeting & Finance	1
	Africa Spectrum	1
	Journal of Public Administration Research and Theory	1
	Journal of Information, Communications and Ethics in Society	1
	Social Science Quarterly	1
	Mediterranean Journal of Social Sciences	1
	American Politics Research	1
	Political Studies	1
	Political Psychology	1
	Political Research Quarterly	1
	Digital Policy, Regulation and Governance	1
	Electoral Studies	1
	Comparative political studies	1
	Sage Open	1
	Journal of information security and applications	1
Law	Election Law Journal	1
	Michigan Law Review	1
	International Journal on Law and Management	1
	Tadulako Law review	1
	Minnesota Law Review	1
Computer Science and Technology	Computers and Security	1
	Computers and Electrical Engineering	1
Economics	The Review of Economics and Statistics	1

3.1.4. Research interest areas

Within the defined paper scope, various research topics were identified; accordingly, following a collective revision process involving both authors, the 42 publications were inductively analysed and categorised into six broad areas: Technology application (e-voting, internet voting, biometric systems, AI & blockchain); Logistics and transportation (reverse logistics and transportation); Human aspects (poll workers, election administrators, managerial capacity, training); Disruptions (rigging, political meddling, barriers to inclusivity, conflict, war); Election operations (cost, wait times, voter registration); Policy and planning (EMBs and EP). However, some publications overlap across multiple areas. For instance, Alvarez and Hall (2006) address both Human and Policy aspects, while Lamb (2021) explores the intersection of operations and logistics. It is noteworthy that although the election process has typically been perceived as a political responsibility, only one paper directly contributed to developing a policy for EL (see Alvarez and Hall 2006). Similarly, there is limited attention to the logistics perspectives of elections, with only one paper specifically focusing on logistics (see Iwuoha et al. 2021), while others address them indirectly as supplementary factors supporting election performance. Table 4 provides a summary of the research topics identified within the reviewed papers.

Table 3. Publications by geography.

Continent	Number of publications	Percentage value
North America	24	57.14%
Africa	7	16.67%
Asia	6	14.29%
Europe	5	11.90%

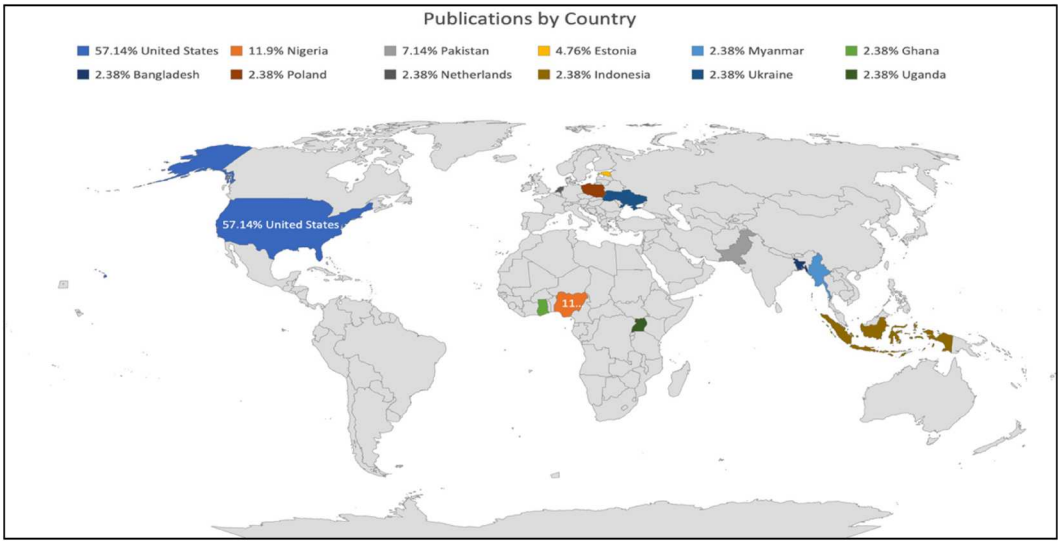

Figure 5. Research interest by geography (Source: Authors).

The evaluation of the selected publications revealed that specific areas such as technology (e.g. Bender 2022; Debrah, Effah, and Owusu-Mensah 2019; Moynihan and Lavertu 2012), human activity (e.g. Alvarez and Hall 2006; Arowosegbe 2020; Claassen et al. 2008; Willemson 2018), and diverse types of disruptions (e.g. Iwuoha et al. 2021; Lidauer 2022) have strong links with EL functionality within EP, and have gained significant traction in recent times.

3.1.4.1. Technological aspects. A large number of studies have been focused on technology perspectives. Scholarly interest in technology follows the contemporary trend in the world in conjunction with the advancement of technology. As supply chain systems, logistics systems, purchasing systems, etc, have been technologized, it appears inevitable that the election process also embraces this trend, demonstrating the interconnectedness of the subject areas. Moreover, as the role of technology impacts the reduction of mistakes, fraud, and unethical events, the effort to improve the election process overall via the adoption of technology has gained significant traction. Furthermore, various information and communication technologies have been adopted to facilitate electoral processes. This integration is predominantly notable in functions such as identity verification and alternative voting methods in lieu of the conventional paper-based system. More recently, it has been observed that technologies, such as blockchain and artificial intelligence (AI)-based algorithms, have been implemented to strengthen EP (See Bender 2022; Khan, Arshad, and Khan 2021). The logistics industry contributes substantially to the development of advanced technology, enhancing higher levels of integration for smooth supply chain operations in EL, especially in areas such as data management, ballot tracking, security, and the entire electoral supply chain management.

Interestingly, the bulk of these technology-related studies have been investigated in developed nations. This emphasis may be attributed to the availability of the requisite technology infrastructure in these regions, substantiating the increased feasibility and applicability of technological interventions within the context of electoral processes. Furthermore, there are mixed opinions regarding the impact of technology on EP. Advocates posit that technology supports a smooth electoral process and has positive impacts on specific measures of election performance, such as the legitimacy, transparency, credibility, and reliability of election outcomes (e.g. Musiał-Karg and Kapsa 2021; Willemson 2018) and ensures inclusivity (e.g. Cottrell, Herron, and Smith 2021; Ntale and

Table 4. Publications by area of interest.

Broad categorisation (Description)	Number of papers	Specific area of interest	Articles
Technology (The deployment of technologies in the electoral process)	12	Electronic voting, internet voting	Alvarez, Ansolabehere, and Stewart (2005), Pieters and van Haren (2007), Musiał-Karg and Kapsa (2021), Ntale and Ngoma (2021), Krivonosova (2022)
		AI & Blockchain	Khan, Arshad, and Khan (2020), Khan, Arshad, and Khan (2021), Bender (2022)
		Technology application and systems for elections	Card and Moretti (2007), Moynihan and Lavertu (2012), Iwuoha (2018), Debrah, Effah, and Owusu-Mensah (2019)
Human side (Management of human resources essential to conducting elections, including the roles, capacities, and training of the individuals involved in the election process)	10	Poll worker, Election administrators and managers	Alvarez and Hall (2006), Claassen et al. (2008), Hall, Quin Monson, and Patterson (2009), Burden et al. (2012), Agu, Okeke, and Idike (2014), Panagopoulos (2018), Porter and Rogowski (2018), Willemson (2018), Arowosegbe (2020), Kasim et al. (2021)
Operations (Practical aspects of running elections, addressing efficiency, financial resources, and processes and systems involved in election performance)	9	Election day operations	Kerr (2018)
		Voter registration	Merivaki (2019)
		Cost	Montjoy (2010), Folz (2014), Lamb (2021), McGowan et al. (2021)
		Inclusivity constraints	Johnson and Powell (2020), Cottrell, Herron, and Smith (2021), Minnis (2021)
		Capacity management, finance, and technology	Kropf et al. (2020)
Disruptions (Factors that can interfere with or compromise the administration and integrity of elections)	6	War, political meddling & violence	Herron, Thunberg, and Boyko (2015), Ahmad et al. (2017), Kuo and Teorell (2017), Mollah and Jahan (2018), Oluwaleye and Ojogbede (2019), Lidauer (2022)
Logistics and Transportation (Planning and coordinating the efficient movement and storage of election materials and personnel)	3	Vote by Mail	Menger and Stein (2018), Lamb (2021)
		Transportation	Iwuoha et al. (2021)
Policy and planning (Implementation of policies and strategies by EMBs to ensure smooth electoral processes)	3	Policy	Alvarez and Hall (2006)
		EMBs and EP	Carroll and Davis-Roberts (2013), Flavin and Shufeldt (2019)

Ngoma 2021). Conversely, sceptics contend that depending on the institution, geography, politics, and systems, technology may exacerbate overall EP due to overburdened work processes and technical interferences inherent to their nature (Debrah, Effah, and Owusu-Mensah 2019; Johnson and Powell 2020; Krivonosova 2022). Nonetheless, their assertions come down to a singular proposition: *electronic voting is inevitable*. Citizens are dispersed across diverse geographical locations globally, and the younger demographic has become technologically savvy. Furthermore, urbanisation has witnessed an upward trajectory, sustainability concerns persist, and societal vulnerability in the face of uncertainty has intensified. Within this context, electronic voting seems to be a prospective and worthy option for future electoral processes, serving as both an alternative to and a supplementary mechanism for traditional voting methods.

The development and increased adoption of electronic voting systems including internet voting and voter registration potentially impact logistics performance in elections. They alleviate the logistics burden by reducing the reliance on large volumes of paper ballots and associated materials, simplifying transportation and storage logistics. It can also enhance the accuracy of voter turnout projections, thereby increasing flexibility in logistics performance and allowing for more adaptive and responsive operations on election day (Kohno et al. 2004). However, these technological advancements can also present logistics professionals with the necessity for additional expertise to support logistics services, along with challenges related to delivery tasks, such as managing

the setup and technical issues of electronic voting machines, as well as handling heavy or sensitive election equipment.

3.1.4.2. Human aspect. Another prominently addressed aspect within EL pertains to human management. This is reasonable, considering that elections are organised, supervised, and completed through human engagement. The quality of EP can depend on the managers of election administration (Kropf et al. 2020). In that sense, many studies on EP considered the human side an important determinant of EP. Literature suggests that key human elements include poll workers, academia and university workers, policymakers, election administrators and officials. Among these, poll workers have been identified as critical, since they interact directly with voters on the frontline, shaping their experiences and overall confidence in electoral outcomes (Cottrell, Herron, and Smith 2021; Hall, Quin Monson, and Patterson 2009). Poll workers could also contribute to constructive and sophisticated operations planning decisions. Their involvement can extend to critical logistics considerations during the election day such as engaging decisions of physical location designing the layout and general aesthetics of the voting centres, and managing waiting times and crowds (Claassen et al. 2008).

More recently, the increasing complexity of elections has been observed as technology has been widely adopted in the election process. Therefore, the focus has been on the capabilities of actors conducting elections and their responsibilities to manage and respond to the problems that may arise due to technology. Particularly, the capabilities of manager-level election administrators have been identified as playing a significant role in reducing voting problems and contributing to professional development for poll workers who perform election day duties and assist voters in using voting equipment and technologies (Agu, Okeke, and Idike 2014; Claassen et al. 2008; Kropf et al. 2020). Their roles are further emphasised as logistics-related decision makers, as involving the entire supply chain of election process, including reverse logistics. They are engaged in the procurement of necessary materials, and transport-related decisions including selecting the types and routes of transport, determining the locations of distribution centres, and managing logistics to address any shortage or surpluses of ballot papers and materials to the places needed during elections. This implies that the enhanced quality of human resources with an understanding of logistics potentially improves process flow, better response to unexpected situations, and financial management, leading to a reduction of overall expenditures and increasing the operational efficiency of election performance. The recent study further adds the importance of having skilled personnel in inventory management, highlighting the need for training election officials to manage election materials with precision and accuracy of inventory to enhance the integrity and efficiency of the electoral process (Charles, Ndolo, and Odari 2023).

Interestingly, the human side of elections in developing nations, which are typically conducted by central institutions, is unique. There is a high rate of military, police, and paramilitary involvement in elections in many developing countries such as Nigeria, and thus, elections take the tone of a 'war-like affair'. This often occurs during the transit of ballots from local polling stations to central collation venues (Agu, Okeke, and Idike 2014). It implies the need to develop bespoke region-specific transportation planning and provide targeted training for individuals involved in transportation activities in developing nations to enhance the logistics of election processes.

3.1.4.3. Disruptions. Disruptions, including war, political meddling, and violence, emerged as intriguing subjects within the context of elections. The publications under this category were based on elections in developing nations, indicating similarities in the characteristics of elections within such regions. It is important to capture that while conversations around disruptions may seemingly sit outside the scope of traditional logistics, they adversely influence specific logistics functions including transport route planning, transport efficiency and security of materials in storage and transit. In this way, logistics capability is closely linked to electoral integrity and election performance. Disruptions seem to be one of the most widely researched concepts since they significantly impact the

legitimacy and reliability of the electoral process and overall election results. The noted disruptions include conflicts within or between nations, as well as interference by internal and external forces (Herron, Thunberg, and Boyko 2015). Although both sides of natural and man-made disruptions have been examined, the latter, particularly political manipulation and interference, has been of significant focus. They are not unusual in both developed and developing countries, but probably more prevalent in developing countries. Disruptions are quite destructive to developing countries, jeopardising not just the integrity and dignity of election systems but also threatening human safety (Lidauer 2022; Mollah and Jahan 2018). Disruptions expose the importance of logistics planning for elections. An examination of physical infrastructure disruption disclosed that EL efforts are severely tested whenever there are natural disasters (e.g. extreme weather events) and anthropogenic challenges (e.g. wars, insurgency, and terrorist events). In such scenarios, voting centres had to be moved, and normal election activities could only take place in regions controlled by security forces (see Herron, Thunberg, and Boyko 2015). Agile logistics can be involved here, responding to the change and adaptation of physical voting places and materials transport to underserviced areas, potentially preventing the disenfranchising of some voters (Lidauer 2022). Other disruptions also exist, such as interference by the actions of political actors, compromised security operatives (who sometimes arrest opposing party agents), hired thugs who disrupt electoral processes by snatching ballot boxes, and voter inducement (Iwuoha et al. 2021; Oluwaleye and Ojogbede 2019). These actions affected the logistics inputs and output processes, such as voter accreditation, actual voting, storage of cast votes, accurate counting of results, transmission of results, etc. Consequently, it can be stated that a more systematic and proactive logistics approach can ensure that the necessary resources are protected and available in a timely manner to support the election process, thereby minimising disruptions of election operations and strengthening the quality of the election process.

4. Discussion

The preceding section provided a descriptive evaluation of studies pertaining to EP and logistics. Building upon this foundation, this section synthesises the key findings, delving into their implications, particularly by aligning with the research questions posed, and provides an in-depth exploration and interpretation of the nuanced insights associated with the role and performance of logistics in the electoral process.

4.1. What are the functional dimensions of logistics in election performance?

The review highlights that the investigation of the logistics functions concerning electoral processes and outcomes has received limited attention over the last two decades, implying that this particular research domain is still in its nascent stage. Iwuoha et al. (2021) investigated diverse logistics challenges intertwined with political interference, particularly identifying the pivotal role of transportation and distribution activities within the realms of both forward and RL. It posited that an optimised framework of transport and distribution plan streamlines and facilitates electoral security during transit, consequently enhancing overall EP.

Other studies acknowledged logistics as a crucial component of elections or subtly advocated factoring them into EP evaluation (see Claassen et al. 2008; Debrah, Effah, and Owusu-Mensah 2019; Willemson 2018). They particularly underlined the significant role of transport and distribution of logistics functions, such as transportation, physical positioning, and the timely delivery of election materials to polling places. Furthermore, the importance of ensuring accessibility in rural or conflict-affected regions has been highlighted. This aspect heightens pertinent consideration in the current contemporary milieu marked by persistent global conflicts and suggests the substantial potential of EL in supporting humanitarian relief efforts. The distinctive characteristic of such conflict-prone regions is the consistent changes in conflict areas, making it difficult to respond

and adapt quickly (Herron, Thunberg, and Boyko 2015). This situation can be found in developing countries where it exposes the high level of risk of interruption by external forces. Therefore, different strategies from general logistics should be considered when it comes to EL in developing countries and conflict-prone regions, for example, resilient and agile transport route planning and decentralised distribution centres. A region-tailored strategic logistical approach also could include active involvement and collaboration with external partners, such as 3PL companies and security agencies. The establishment of alliances externally can serve as a pragmatic and agile means to mitigate the inherent risk associated with theft, fraud, and manipulation, thereby contributing to the effective EL and the integrity of the electoral process.

Positive EL performance is characterised by the efficient and safe movement of materials, personnel, and equipment throughout the inbound, outbound and RL processes (Iwuoha et al. 2021; Kuo and Teorell 2017). In this sense, a standard for EL with logistics-focused technologies should encompass ballot tracking, ensuring election materials and equipment tracking. Furthermore, a core tenet of optimum EL performance is measured in terms of the safety of materials, personnel, and equipment during transit and storage. Instances of theft of electoral materials at any point across the supply chain (Iwuoha et al. 2021) and assaults on personnel (Arowosegbe 2020) throughout the process indicate poor EL performance, jeopardising the integrity of the electoral outcome. The significant contribution of logistics lies in securely transporting and storing electoral materials (Iwuoha et al. 2021; Oluwaleye and Ojogbede 2019) while supporting visibility across the entire electoral process, from the preliminary planning stages to procuring materials and voting administration. This can be realised through the integration and digitalisation of logistics systems within the electoral process, facilitating real-time information and data management (Card and Moretti 2007; Debrah, Effah, and Owusu-Mensah 2019; Iwuoha 2018; Kerr 2018). This strategic approach enables the seamless execution of principal supply chain management flows within the electoral process, ensuring safety and accessibility, particularly in unforeseen circumstances.

4.2. What are the prevalent challenges within election process from a logistics perspective?

The reviewed literature evidently discussed certain challenges, which can be categorised from a logistics perspective into six overarching areas: personnel and management, operational challenges, technology-related challenges, transportation and warehousing issues, RL challenges, and externally influenced disruptions.

4.2.1. Personnel and management

Reviewed studies reveal a constellation of challenges around personnel; encompassing deficient training for personnel, interference by poll workers, inadequate poll worker-to-voter ratio, and collusion between political party actors and electoral administrators. The challenges related to political meddling were particularly found to be more prevalent in certain regions of the world, such as Sub-Saharan Africa (see Agu, Okeke, and Idike 2014; Debrah, Effah, and Owusu-Mensah 2019; Kerr 2018), certain parts of Asia (see Lidauer 2022). The existence of these issues results in tangible ruination of voter trust and confidence in these regions, indicative of deeper societal issues intertwined with poverty and cultural dynamics.

These challenges were further linked to poor security infrastructure and planning, as well as the presence of compromised security operatives (Iwuoha et al. 2021; Oluwaleye and Ojogbede 2019). They may also be associated with deficient oversight, experience, and training among managers and supervisors, as well as inadequate cooperation among key players involved in the election process (Arowosegbe 2020; Kropf et al. 2020). Election workers and administrators often lack comprehensive knowledge of the logistics system, making it difficult to appropriately incorporate and respond to logistics-relevant activities and decisions in election planning and administration (Iwuoha et al.

2021). Besides, the role of logisticians in the election process has been overlooked despite their potential to bring benefits and a positive impact on EP. With inadequate oversight of logisticians like 3PL or 4PL, it can result in critical lapses in the monitoring and management of logistics operations, raising the risk of errors and delays that can have far-reaching consequences for election supply chain and performance (Lai and Cheng 2003).

Additionally, there is a likelihood that some poll workers may be connected to the infiltration of the workforce by compromised elements, denoting inadequate background checks for poll workers and suboptimal security setups (Arowosegbe 2020). Such compromised security operatives may have the potential to manipulate logistics operations, potentially leading to the loss or tempering of ballots during transportation or storage, which could undermine the security and integrity of the EL and EP. This is where tools designed and applied to support logistics operations – such as RFID, GPS tracking, drones, blockchain-based security management, automated incident reporting systems, and tamper-evident packaging – can further contribute to preventing these outcomes (Chen et al. 2024; Min and Park 2007; Rajan et al. 2024).

4.2.2. Operational challenges

Several operational challenges include a lack of capacity to handle seasonal registration spikes, inclusivity issues, and problems like multiple voting and ballot tampering, all of which have been identified to be interconnected with logistics factors (see Cottrell, Herron, and Smith 2021; Johnson and Powell 2020; Minnis 2021). The capacity to handle registration surges is not just a matter of human resources but also requires a robust logistics framework that includes efficient allocation of registration materials, deployment of mobile registration units, and timely communication to potential voters. Seasonal registration spikes are more evident in regions where voter registration is done manually with limited use of online registration platforms, and with heavy reliance on physical biometric data capture points in preparation for election cycles, with the aim of capturing new voters while de-registering deceased voters and limiting voter registration fraud (see Debrah, Effah, and Owusu-Mensah 2019). Without proper logistical planning and forecasting, even well-trained personnel may struggle to manage the surge in voter registrations, leading to long wait times and potential disenfranchisement.

Inclusivity challenges, such as addressing language barriers and providing accommodations for disabled voters, also intersect with logistical operations. The effective distribution of multilingual ballots, the provision of accessible polling stations, and the availability of assistive devices all depend on meticulous logistical planning. Election officials need to ensure that an adequate supply of ballots in multiple languages is printed, stored, and available for distribution to polling stations (Shanton 2019), where poor logistics management can lead to waste or logistical challenges in the election process. Furthermore, devices such as screen readers, braille ballots, or ramps for disabled voters need to be inventoried accurately. This fundamentally includes knowing how many are needed, where, when, and how they should be stored and distributed. This can be also associated with the safe delivery of these devices, which must arrive undamaged and be set up correctly and may involve special transportation arrangements. If election logisticians fail to anticipate this need, the inclusivity of the election process may be compromised, potentially excluding significant portions of the population (Charles, Ndolo, and Odari 2023; Norris 2015).

Seasonal voter registration spikes and inclusivity challenges could be due to poor planning and forecasting, as well as budgetary constraints (Johnson and Powell 2020; Kropf et al. 2020). To address these challenges, the examination of data from previous registration cycles and the use of predictive data models, along with forecasting tools, could be useful to plan for these seasonal spikes. However, recurring challenges may persist in situations where data management maturity levels and infrastructure are low or non-existent. Additionally, poor awareness of inclusivity constraints may result in election planning overlooking the specific needs of those directly affected by the lack of such amenities and support systems.

Moreover, issues like multiple voting and ballot tempering can be exacerbated by insecure transportation and storage of ballots, personnel and management challenges arising from compromised poll workers (Arowosegbe 2020) and insufficient training (Kropf et al. 2020). Poll workers, who are essential to the election process, are often involved in managing and allocating resources such as ballots, voting machines, and assistive devices throughout the election day. Elections are inherently dynamic, often presenting unexpected challenges such as equipment failures or higher-than-expected voter turnout can occur (King 2020). Therefore, ensuring that all polling stations have the necessary resources and that they are replenished as needed can be one of the significant logistical tasks for poll workers. However, a slow response to changes and unforeseen issues on the spot at polling places, coupled with a lack of real-time communication and coordination among poll workers, election officials, and logisticians, can lead to significant bottlenecks, escalating confusion during the election process but also increase operational costs and negatively impact overall election performance (Chang and Lin 2019; Christopher and Peck 2004; Jena and Ghadge 2021; Norris 2015).

4.2.3. Technology

Technology-related issues tend to be widespread across various regions (see Alvarez, Ansolabehere, and Stewart 2005; Krivonosova 2022; Musiał-Karg and Kapsa 2021; Pieters and van Haren 2007). Challenges within technology and technological infrastructure encompass the failure of IT equipment, poor voice and internet networks, and data transmission issues (Card and Moretti 2007; Ntale and Ngoma 2021). From a logistics perspective, the increasing use of election-related technologies introduces potential challenges in the delivery and retrieval of electronic ballot boxes. It is essential that each machine be delivered to the correct polling station, as they contain unique voter records; any errors would make voting impossible at that location. All machines must be collected precisely at designated times from multiple locations and returned to different storage facilities within a short timeframe. Managing the delivery of a large volume of sensitive electronic machines within a constrained time increases the complexity of logistics operations in terms of special vehicles, training personnel for handling, transport scheduling, routing, and resource allocation. This, in turn, leads to an increased burden of operational costs in logistics (Alles, Pachón, and Muñoz 2021; de Freitas and Macadar 2017).

These technological challenges are more pronounced in rural areas and hinterlands with geographical access issues, affecting regions with limited technological infrastructure (Debrah, Effah, and Owusu-Mensah 2019; Iwuoha 2018). This suggests the importance of a comprehensive understanding of the peculiarities of each location in planning technological inputs for EL, as it is critical for the success of the logistics function. Instances, where such challenges persist, reflect a lack of awareness and planning as it relates to the practicalities on the ground. This implies that region-specific technologies are necessary, rather than adopting a singular technology approach across an entire nation. Moreover, there is a need for initial investments in technological infrastructure prior to the election circle, serving as a foundation for the deployment of up-to-date integrated logistics technologies (Card and Moretti 2007; Debrah, Effah, and Owusu-Mensah 2019; Iwuoha 2018). However, the success of this approach is greatly dependent on budgets, poll worker training and skills, as well as the political will (Folz 2014; Kropf et al. 2020; McGowan et al. 2021) necessary for the implementation of such large-scale infrastructure projects.

4.2.4. Transportation, warehousing, and inventory control

Collation centres tend to have their own challenges. In certain circumstances, there is a high potential for connivance between political party actors and electoral administrators during the collation process (Arowosegbe 2020). From an LSCM perspective, the nature of this challenge firmly falls within the scope of warehousing, more specifically involving load consolidation, inventory control, and centralised storage, as the results from polling units are transported to a collation centre (i.e. warehouse) for aggregation prior to the release of results. Therefore,

the vulnerabilities and challenges associated with the collation process in elections can affect the fairness of elections. On the other hand, these problems also have a human element as election administrators and poll worker connivance and meddling are introduced due to the involvement of human factors (Arowosegbe 2020; Oluwaleye and Ojogbede 2019). Compromised electoral administrators may prioritise certain areas or demographics, resulting in uneven distribution of individuals and equipment. This can directly affect logistics by creating inefficiencies in resource management, leading to shortages or surpluses in specific locations, which can hinder the overall effectiveness of the election process.

Other observable transportation and warehousing challenges highlighted in the literature were delays in the transportation of electoral materials, long travel routes and distances, wide intervals between polling units, voter residences, and poll workers' residences, issues with securing the ballots, road-unworthy vehicles, and poor route planning (Iwuoha et al. 2021). They further highlighted that late arrival of voting materials due to 3PL failures and vehicular breakdowns, poor visibility of the entire logistics networks, and a loose chain of custody of election materials (indicating inadequate inventory management practices) are prevalent issues. Interestingly, these categories of challenges were seen to be more common in developing countries characterised by unconsolidated democracies. They could reflect not just poor infrastructure but also scarce transportation planning capabilities of EMBs and a lack of specialist knowledge among employees and partners. These challenges reflect a lack of understanding with regard to the intricate role of logistics in election administration. Moreover, there is the continued existence of human-side challenges (Cottrell, Herron, and Smith 2021; Hall, Quin Monson, and Patterson 2009) occurring as the issue of a loose chain of custody denotes insufficient management oversight and may also point to a failure in the procurement function of EMBs. This recurring nature of these logistics failures, especially as it relates to 3PLs, suggests the absence of proper contracts, contract management, and service level agreements between the procurement function of EMBs and service providers. It could also imply the presence of ineffectual legislative frameworks required for contract enforcement and management.

4.2.5. Reverse logistics

RL emerged as another problematic area. Challenges associated with voting by mail (late return of ballots), added costs associated with counting ballots returned ahead of results day, and sabotage from logistics providers – were the characteristics of RL challenges. However, the nature of the problems associated with RL differs by regional nomenclature. For example, the issue of sabotage and deliberate failure to fulfil RL obligations by logistics providers was an isolated case captured in the Nigerian EL scene. In this case, poll workers and electoral materials tend to be stranded post-voting and must then source alternative means of transportation back to collation centres at odd hours due to the failure of some 3PL providers to return for the RL leg of the process (Iwuoha et al. 2021). Additionally, the issues identified under warehousing, transportation, and inventory control tend to be replicated at the RL leg of the logistics process. Other issues such as late return of ballots, associated costs, and vote-by-mail challenges were observed in more logistically advanced countries, such as the United States and other countries where postal voting or vote by mail (VBM) is an acceptable voting practice. As highlighted, the predominant challenge lies in the RL aspect of the entire electoral process, as there tends to be a late return of ballots, which in turn leads to added costs associated with counting ballots returned ahead of results day (Menger and Stein 2018). This suggests that while RL comes with widespread challenges, the causes and prevention strategies will be region-dependent.

4.2.6. External influenced challenges

The literature suggests that while some significant challenges are endogenous, there are some impactful exogenous challenges. As mentioned earlier, natural disasters and socio-political conflicts could have adverse effects on the logistics capabilities required to successfully administer elections.

Conflicts, wars, insurgencies, and terrorist activities have been found to significantly impede voter, candidate, and electoral body functions and civic duties (Herron, Thunberg, and Boyko 2015; Lidauer 2022). Logistics functions also tend to be severely compromised during wars, and extreme weather events.

In the cases of war or insurgency, the ability to successfully deliver EL relies heavily on integrating local security infrastructures with the EL frameworks (Herron, Thunberg, and Boyko 2015). This ensures that voting materials and workers are transported, stored and secured throughout the entire process. Regarding weather events, there is a need for systematic integration of EL and emergency services to ensure successful elections. This integration might be relatively tedious and expensive, as it requires early involvement with the requisite services and a more expensive and robust planning approach to capture how materials storage and transport, workers and even voter logistics may be explicitly handled by these emergency and security services. This may also entail additional considerations related to requisite training, chain of custody of election materials, and an increased risk of infiltration.

4.3. What potential research directions can be explored within the context of election logistics?

From the reviewed literature, four potential future research directions have been identified. Firstly, it is apparent that there is little or no focus on the upstream aspects of EL, indicating a lack of consideration for procurement, procurement planning, and supply logistics aspects of elections. It is critical to gain insights into the complexities of electoral supply chains, particularly, in developing countries, considering the global length of these supply chains and their impact on electoral budgets, logistics, and transport infrastructures, and, ultimately, the success or failure of electoral processes. While procurement may sit outside the traditional scope of logistics, it is a critical input into logistics and logistics design as it affects supply and inbound logistics, along with the quality of logistics providers contracted for 3PL services. This is especially important as it covers expenditure and certain aspects of the forward logistics involved in election administration.

Secondly, studies on the impact of outsourcing logistics functions for election administration and its relative success or failure across regions are also scarce. The work of Iwuoha et al. (2021), which examined the Nigerian case, suggests that where these functions are outsourced it exposes the logistics infrastructure to external influences and sabotage. However, it would be worthwhile to investigate if this is a widespread occurrence in other developing nations, while also comparing it to developed countries. Similarly, there is limited focus on the nature of warehousing designs (encompassing election material storage, technology, and security), logistics optimisation, and materials management for elections. Exploratory Studies should be conducted to identify the most suitable supply chain strategies for electoral supply chains, examining whether there are generic strategies or region-specific best-fit strategies.

Thirdly, RL has been highlighted to be a significant challenge in the EL of developing nations, exemplified by Nigeria and Ghana as demonstrated by Kerr (2018); Iwuoha (2018); Oluwaleye and Ojogbede (2019); Debrah, Effah, and Owusu-Mensah (2019); Arowosegbe (2020); Iwuoha et al. (2021). However, this area has received inadequate attention. The examination of public transportation systems and their impact on poll worker efficiency, as well as the unhindered movement of voters on election day, is another critical area for study. Studies focused on material transport route planning, distribution, and distribution strategies are also essential for the advancement of EL and administration. A comparison of the practices of developed and developing nations may provide insights and solutions for problems faced by either side of the divide. Currently, much of the reviewed literature from developed nations has been from the United States, and this does not provide sufficient grounds for generalisation. Thus, further research on the EL logistics practices of other developed nations would be essential for such comparisons to take place.

Lastly, the nature of technology required for logistics optimisation and integration within the confines of elections can provide insights into cost planning and deliverables, especially in hinterlands, rural and hard-to-reach regions. Exploring region-specific transportation modes and the associated challenges related to election administration can clarify optimal planning for low-access areas and the technological support systems required to enable electoral processes in hard-to-reach regions.

5. Conceptual framework of election logistics

Drawing from the reviewed literature, it can be stated that election processes are strategically embedded with logistics activities, and the multifaceted logistics functions can ensure high-quality electoral outcomes. Table 5 provides an overview of the key findings derived from the reviewed studies. It includes the essential points identified in the systematic literature review, highlighting the most significant themes and factors for the EL and EP.

The review reveals that, beyond traditional logistics activities, understanding the certain factors influencing the broader EL chain is critical. While EL shares certain objectives with commercial logistics, it has distinct differences in terms of degree of flexibility, time sensitivity, and the different stakeholders and policies involved. Unlike general commercial logistics, which often allows for flexibility and adaptability in delivery schedules based on demand and supply chain dynamics, EL operates under strict deadlines that necessitate a more rigid structure due to the stringent laws and policies governing its operations, all aimed at preserving the integrity of the electoral process. Additionally, the review highlights the critical importance of ensuring the safety and security

Table 5. Summary of key findings from the reviewed studies.

The functional dimensions of logistics in election performance	**Secure transport and distribution** • Timely delivery of election materials • Accessibility in rural or conflict-affected regions • Efficient, secure, and safe movement of materials, personnel, and equipment **Storage and Inventory Management** • Physical positioning (storage layout, items placement, inventory management) • Tracking the movement of election ballots, materials and equipment • Security in transport and storage electoral materials **Visibility and Integrity** • Real-time visibility across logistics chain including reverse logistics • Application of tailored expertise in logistics knowledge to electoral planning and policy
Factors causing logistics challenges	**Leadership and Operational challenges** • Lack of managerial or supervisory oversight • Inadequate personnel training • Poor security infrastructure • Inclusivity practices **External Disruptions** • Political meddling • Wars and conflicts • Sabotage by external partners
Election performance	**Technological Performance** • Data management (data capture, data transmission, data storage) • Visibility and security (tracking ballots, materials in storage and in transit) **Human Resource Performance** • Competent security protocols • Electoral planning and resource allocation • Capability of actors involved in election process **Electoral Supply Chain Resilience** • Agility in adapting to unforeseen events • Resilience against disruptions • Seamless integration of forward and reverse election logistics

of both materials and individuals involved in EL, especially when engaging third or fourth-party logistics service providers. This point is heightened by various internal and external factors that can pose significant logistics challenges. These include a lack of expertise and oversight in logistics, political interference, wars and conflicts, all of which can disrupt transit operations and create safety risks for personnel, ultimately compromising the effectiveness of EL and EP. In this sense, EL should develop a certain level of adaptability within its logistics systems, despite the inherent rigidity of election processes. The review implies that specialised logistics technologies, particularly tracking systems, along with the role of specialised logistics professionals could have the potential to achieve both adaptability and rigidity in EL, guaranteeing the smooth flow of inbound, outbound, and reverse EL. Given the distinct demands of EL – such as dealing with sensitive items, adhering to strict timelines, reaching diverse geographic locations, and addressing unforeseen disturbances – it is imperative to cultivate a workforce of trained logisticians who are knowledgeable about the specific protocols and requirements related to election processes.

Therefore, the foremost priority in EL, while expanding the role of traditional logistics where efficient movement is the ultimate goal, is to implement secure logistics management across its core activities and components. Consequently, the EL performance can significantly contribute to three key areas of election performance identified in the review: technological performance, human resource performance, and electoral supply chain resilience. The three areas (EL, challenges, and EP) are fundamentally interconnected, with physical operations intrinsically embedded across the three. Building upon these three aspects, Figure 6 presents a conceptual model proposed as a framework for understanding the role and application of logistics in EP.

From a managerial perspective, the examination of each of these topical areas and dimensions within election administration offers profound insights into the dynamics of EP in different geographies. The integration of these dimensions provides the foundation for integrated EL. In other words, an EL strategy that does not capture these dimensions cannot be classed as truly integrated and may fail to yield optimum EP outcomes. Each dimension requires granular inputs that must be strategically accounted for and executed with high levels of visibility. Furthermore, the review proposes that EP is directly influenced by the effectiveness of EL. When the dimensions are well integrated, it will likely result in a successful EP. The study further suggests that external factors potentially shape the integration of EL. More so, where external factors are not properly accounted for, it could adversely impact finance and the capacity of the logistics functions internally. The capacity and functionality of these dimensions in the presence of these exogenous factors ultimately affect EP, particularly if they are insufficiently considered. While there are limited academic insights into this, the study captures the nature of the interdependencies between technology, human side and logistics; providing insights for election administrators, showcasing the scope of current challenges, the need for specialist logistics involvement and the integration of logistics capacity planning into elections.

From a scholarly perspective, the review findings suggest that LSCM research has not accounted for the association between logistics inputs, democracy and social justice. Utilising an inductive approach, this framework shows the essential nature of logistics systems, i.e. warehousing, forward and reverse logistics, transport planning, supporting technology, and human inputs to electoral outcomes. The review findings suggest that any interventions developed for the advancement of successful delivery of elections should address logistics inadequacies within electoral systems and electoral supply chains, as these impact the credibility acceptance of electoral outcomes.

6. Conclusion

The aim of this study is to increase the knowledge of the critical role played by logistics in influencing election performance. The study adopts a systematic literature review in order to identify existing academic contributions regarding logistics in electoral processes, which is the first attempt at the election logistics subject. Extant studies have often overlooked the operational aspects of elections, notably within the domains of LSCM, however, it is imperative to recognise that elections take place

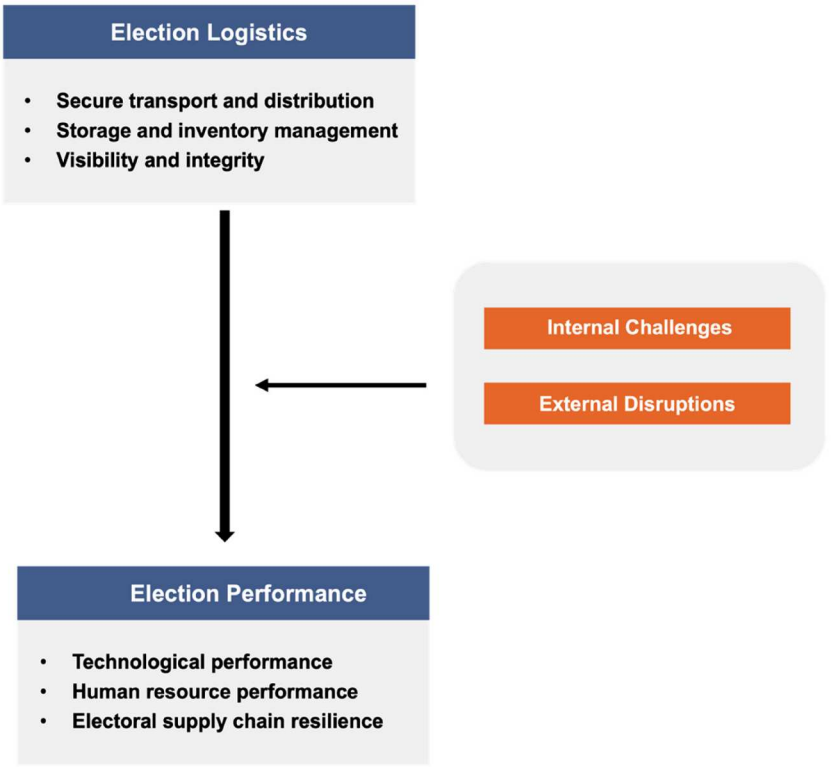

Figure 6. Conceptual framework for integrated EL (Source: Authors).

via the meticulous integration of various logistics components, i.e. procurement, transportation, warehousing, distribution and inventory management activities; and without strategic logistics interaction sensitive electoral materials cannot be moved and secured, consequently compromising electoral integrity and the capacity of democratic governments and the economic security associated with governmental performance. This study argues that EP cannot be successfully achieved only for traditional logistics components, which need to consider an election-specific solution, establishing secure logistics systems, by technologies utilised in logistics areas, appropriate safety and security management, and human resources management, on top of that, appropriate measures for external interruptions.

Accordingly, a conceptual framework is proposed for the integrated EL that contributes to EP. In doing so, this study advances scholarly discussions, cultivating a more sophisticated understanding of the conceptual structure crucial for investigating EL. The conceptual framework extends beyond academic boundaries, presenting evidence-based information about improving the efficiency and efficacy of EP in practice, benefiting those engaged in the practical implementation of electoral processes, including policymakers and decision-makers within election administration. By surfacing concealed conceptual underpinnings, the study provides a methodological foundation for researchers seeking to grasp and analyse the complex nature of election logistics and assess election performance with logistics activities. Additionally, this study clearly shows the key logistics factors that serve as a structured framework for evaluating EP. The identification of these indicators is the first attempt in the research field of election performance, providing a novel and comprehensive vantage point on the intersection of election performance and logistics.

However, there are certain limitations to this study. Although the number of reviewed papers stands at 42 – a reasonable figure within the systematic literature review research field – the dearth

of exploration on the impact of logistics on election administration is notable. This deficiency offers some degree of bias and limitation to the study, constraining its perspective on the broader role of logistics in overall EP. Methodologically, the study exclusively considered peer-reviewed articles, neglecting grey literature, where potentially relevant and meaningful arguments might exist. Furthermore, this study is more focused on comprehending the phenomenon, aligning with academic interests rather than providing practical insights. Hence, future research should explore the perspectives of election administrators who are actively engaged in election processes. This inclusion would be valuable to establish optimal logistics indicators that are not only practical but also feasible for assessing EP. By doing so, actionable insights into logistics indicators can be acquired, empowering administrators to make well-informed decisions about election operations and relevant policy directions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

No new data were created or analysed in this study. Data sharing is not applicable.

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